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FINAL ENVIRONMENTAL ASSESSMENT

SELECTIVE NONCATALYTIC REDUCTION PROJECT JOHNSONVILLE FOSSIL PLANT – UNITS 1-4

Humphreys County, Tennessee

TENNESSEE VALLEY AUTHORITY

MAY 2006

Final Environmental Assessment **May 2006**

Proposed project: Selective Noncatalytic Reduction Project
Johnsonville Fossil Plant – Units 1-4
Humphreys County, Tennessee

Lead agency: Tennessee Valley Authority

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Abstract: Nitrogen oxide, generically called “NOx,” is an air pollutant that can lead to the formation of ozone. In 2005, the Tennessee Valley Authority (TVA) installed a selective noncatalytic reduction (SNCR) system on Unit 1 at Johnsonville Fossil Plant to reduce NOx emissions. Results have been favorable, and TVA now proposes to install SNCR on Units 2, 3, and 4 and to operate the SNCR systems year-round. The two main issues addressed in the environmental review were air quality and water quality, including the potential effects of water-quality degradation on threatened and endangered mussels. Both air quality and water quality are potentially affected by ammonia slip (i.e., the passage of unreacted ammonia through the flue gas).

Analysis indicated that overall air quality would benefit from implementing the proposed action. Operation of the proposed SNCR system on the four units would reduce NOx emissions, which would also reduce ozone formation.

Similarly, water-quality degradation (primarily from the presence of unreacted ammonia, i.e., ammonia “slip”) would be minor and insignificant. Outfall discharges would be managed to comply with permit requirements. Also, because there is a large amount of mixing at the outfall, ammonia concentrations in the Tennessee River would be below toxic levels for mussels. Therefore, there would be no effects to endangered mussel species in the Tennessee River.

Overall, potential environmental impacts would be minor and insignificant.

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CHAPTER 1

1. PURPOSE OF AND NEED FOR ACTION

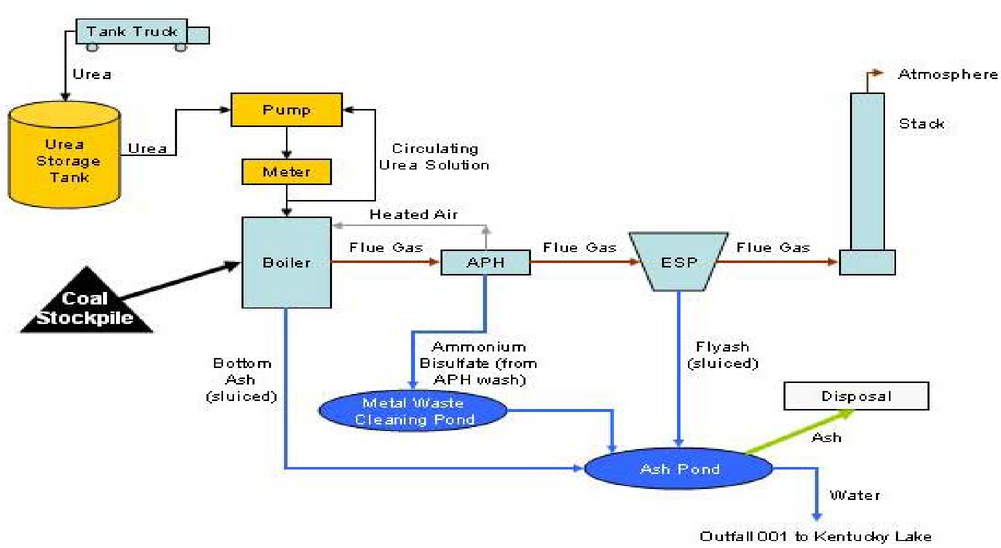
1.1. The Decision

Nitrogen oxides, frequently referred to as "NOx," are compounds composed of nitrogen and oxygen. NOx is formed as a byproduct when nitrogen in the air reacts with oxygen during the high-temperature combustion of coal. NOx emissions are a major air pollutant and contribute to the formation of acid rain and ground-level ozone. Section 110 of the Clean Air Act and the Clean Air Interstate Rule require reductions of NOx emissions from existing sources. To help meet these requirements, the Tennessee Valley Authority (TVA) is proposing to install equipment on Units 1, 2, 3, and 4 at the Johnsonville Fossil Plant (JOF) for removing NOx from coal-combustion flue gas. Initially, this equipment would be operated during the ozone season, i.e., May through September. However, starting in 2009, the equipment would be operated on Units 1, 2, 3, and 4 on a year-round basis. A process known as selective noncatalytic reduction (SNCR) would be used. The decision before TVA is whether to proceed with the installation of the necessary equipment and the operation of the proposed SNCR system on the four units at JOF.

1.2. Background

1.2.1. The SNCR Process

SNCR technology was researched in the early 1970s by the Electric Power Research Institute. A schematic diagram of the SNCR proposed for installation at JOF is provided as Figure 1-1. A brief description of the process is given below.



APH = Air Preheater (2 APHs per unit)
ESP = Electrostatic Precipitator (1 ESP per unit)
Note: The SNCR components are shown in yellow

Figure 1-1. Schematic Diagram of Johnsonville Fossil Plant

SNCR involves the precise injection of a nitrogen-based reducing agent such as ammonia (NH_3) or urea ($CO(NH_2)_2$) into the hot exhaust (i.e., the flue gas) from the boilers. The reducing agent converts NOx to molecular nitrogen.

The proposed SNCR systems would utilize the urea-based process. In this process, urea is dissolved in water, and this solution is sprayed into the hot flue gas. The urea breaks down into several other similar compounds that react with NOx to form elemental nitrogen, carbon dioxide (CO_2), and water.

The urea-based SNCR processes require high temperatures, and the optimal temperature range is 1,700 degrees Fahrenheit (°F) to 1,950°F. Other factors affecting SNCR performance include the proper metering and mixing of the chemicals with the flue gas, adequate residence time of the reducing agent in the hot flue gas (in order to allow the chemicals to react properly), concentrations of carbon monoxide in the flue gas, and levels of sulfur in the coal. In addition, different coals exhibit different characteristics with respect to SNCR efficiency.

For a variety of reasons, some of which are not well understood, not all the urea reacts in the process of removing NOx. The remaining reducing agent that does not react is usually present in the form of ammonia and is commonly called "ammonia slip" or simply "slip." Some of the ammonia slip can remain in the flue gas and eventually will exit the stack to the atmosphere. Likewise, some of the ammonia can adhere to the fly ash as it is carried along in the flue gas. Fly ash consists of small particulate matter that is suspended in the flue gas stream. At JOF, fly ash is removed from the flue gas by electrostatic precipitators (ESPs) (see Figure 1-1) and then is sluiced to the ash pond.

Many coals contain trace amounts of sulfur. This sulfur reacts with oxygen when the coal is burned and forms sulfur oxides commonly called "SOx." In situations where SOx is present in the flue gas, the ammonia slip can react with SOx to form ammonium bisulfate (NH_4HSO_4). Ammonium bisulfate is a sticky material that can accumulate on surfaces along the flue gas stream, especially the air preheaters (commonly referred to as the "APHs"). The APH is a device that extracts heat from the flue gas stream and transfers it to incoming fresh air used for combustion (see Figure 1-1).

1.2.2. Site Description

JOF is located on 720 acres on the east bank of Kentucky Reservoir, an impoundment of the Tennessee River, near Waverly, Tennessee (see Figure 1-2). The plant has 10 generating units with a combined capacity of 1,350 megawatts. JOF is the oldest fossil plant in the TVA system. Plant construction began in May of 1949, and the first generating unit went into operation in October 1951. JOF consumes about 9,600 tons of coal per day, and generates about 550 million kilowatt-hours of electricity a year, enough to supply 400,000 homes. JOF supplies an adjacent industry, DuPont, with process steam for the manufacture of titanium dioxide.

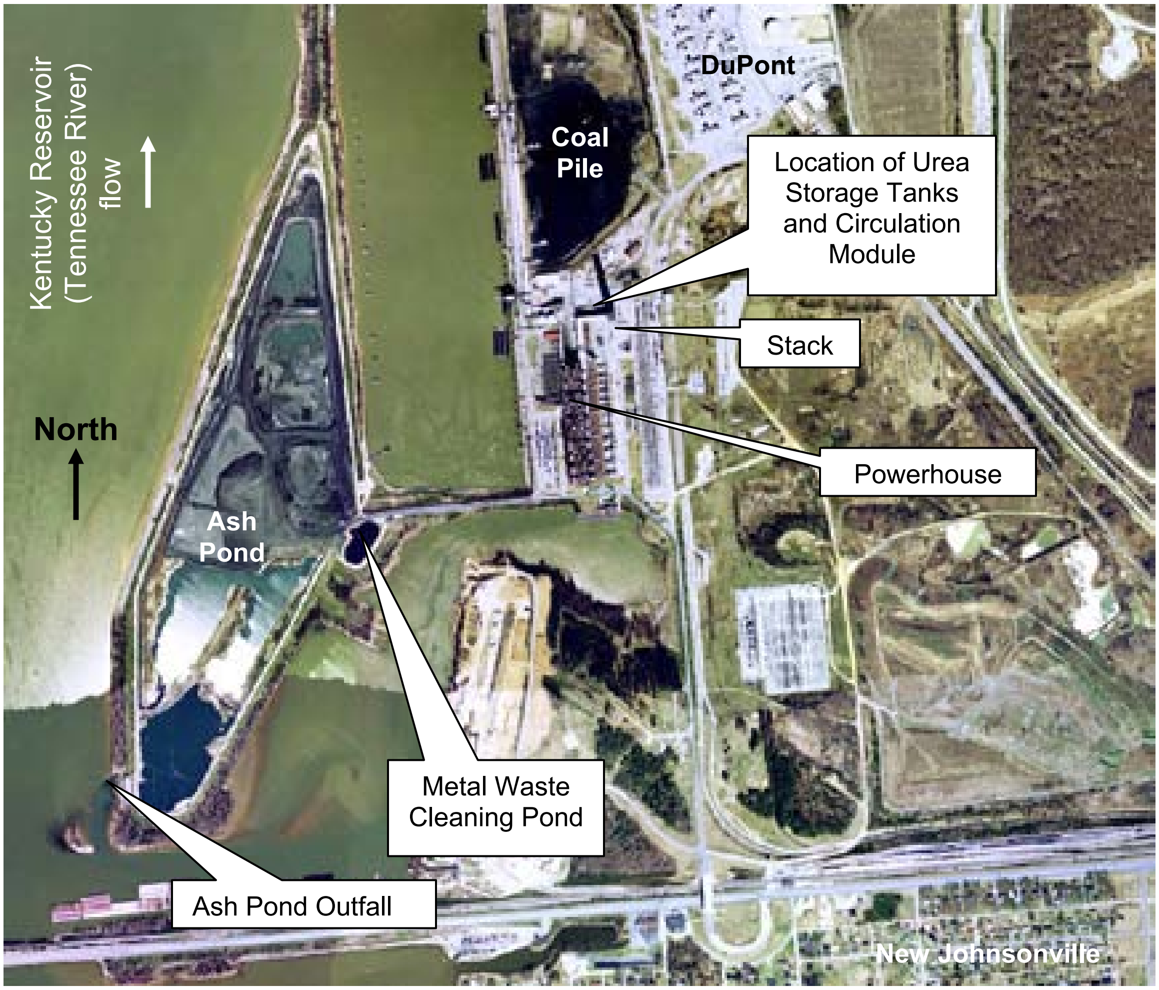


Figure 1-2. Johnsonville Fossil Plant Site

1.3. Other Pertinent Environmental Reviews or Documentation

NOxOUT Selective Noncatalytic Reduction Demonstration, Johnsonville Fossil Plant - Unit 1 Environmental Assessment, Tennessee Valley Authority, April 2005, (TVA, 2005a). This Environmental Assessment (EA) addressed the potential environmental effects of a pilot study of an SNCR installation on Unit 1 at JOF. The NOxOUT® system used in this pilot project used a urea-based SNCR process. TVA completed the first phase of a two-year demonstration project in October 2005. As appropriate, findings from the previous EA, as well as portions of it, have been incorporated into the present EA.

Installation of a Flue Gas Conditioning System, Johnsonville Steam Plant Environmental Assessment, Tennessee Valley Authority, October 2004 (TVA, 2004). Previously, TVA proposed to install a flue gas conditioning system that would have allowed switching of all 10 units at JOF to a low-sulfur coal. Installation of the proposed flue gas conditioning system would require the on-site storage and use of anhydrous ammonia. This project, originally scheduled to start in the spring of 2005, has currently been cancelled.

Johnsonville Fossil Plant - Development of Long-Term Ash Management Strategy Environmental Assessment, Tennessee Valley Authority, February 2002 (TVA, 2002). This programmatic EA was used to evaluate potential effects of an ash management strategy at JOF.

Energy Vision 2020 - Integrated Resource Plan Environmental Impact Statement, Tennessee Valley Authority, December 1995 (TVA, 1995). This programmatic Environmental Impact Statement was prepared in concert with the development of an overall strategy for meeting the energy needs of the Tennessee Valley through the year 2020.

1.4. The Scoping Process

A TVA interdisciplinary team reviewed the proposed project for potential direct, indirect, and cumulative effects of implementing Alternative A, the No Action Alternative, and Alternative B, Installation of an SNCR System on JOF Unit 2-4 and Year Round Operation of an SNCR system on JOF Units 1-4. This alternative also includes the option to install and operate the SNCR system on all or some of these units. Potentially affected resources include air, water (industrial wastewater, surface water, and groundwater), solid waste, aquatic ecology, and protected aquatic species. Potential effects to these resources were considered in the 2005 EA. Because of the expanded nature of this proposal over the pilot project, additional potential effects to these resources were evaluated. For similar reasons, potential effects to terrestrial biology, wetlands, natural areas, and cultural resources were also considered. Other potential effects considered to a lesser degree included prime farmland, land use conflicts, interbasin transfer of water, navigation, environmental justice, floodplains, construction debris, surface transportation, and aesthetic quality.

1.5. Necessary Federal Permits, Licenses, or Notifications

If the Action Alternative were adopted, the following would be obtained:

- An asbestos removal notification would be obtained for boiler penetration work.
- TVA would inform the Tennessee Department of Environment and Conservation (TDEC) of the planned changes, and a National Pollutant Discharge Elimination System (NPDES) permit modification could be required for ammoniated wastewater discharge from Outfall 001.

CHAPTER 2

2. ALTERNATIVES INCLUDING THE PROPOSED ACTION

2.1. Alternatives

Two alternatives were considered. These were Alternative A, i.e., the No Action Alternative, and Alternative B, which is the Action Alternative. These two alternatives are described in detail below. The potential environmental consequences of adopting each of these alternatives are also described.

2.1.1. Alternative A – The No Action Alternative

Under Alternative A, TVA would continue the pilot study of the SNCR system on Unit 1 through 2006, and SNCR systems would not be installed on Units 2, 3, and 4 at JOF. At the end of 2006, the SNCR system would be deactivated. Most of the existing SNCR equipment would be left in place on Unit 1, as it would not affect normal unit operation. The temporary urea storage tank would likely be removed. Under Alternative A, there would be no physical or routine operational changes to JOF.

2.1.2. Alternative B – The Action Alternative (Installation of an SNCR System on Units 2, 3, and 4, or Any Combination Thereof, and Year-Round Operation of SNCR System on Johnsonville Fossil Plant Units 1, 2, 3, and 4)

Under Alternative B, TVA would install SNCR systems on Units 2, 3, and 4, or any combination thereof at JOF. The SNCR system on Unit 1 would continue to be operated. SNCR installation on Unit 4 is tentatively scheduled for the summer of 2006, with a planned completion date of spring 2007, including system optimization and operation by May 1, 2007. Installation on Units 2 and 3 would follow, and TVA would operate the proposed SNCR system on Units 1, 2, 3, and 4 year-round starting in 2009. In the interim, the SNCR systems would likely be operated during the ozone season.

Under Alternative B, there would be some minor physical additions at JOF. TVA would install two tanks with a maximum capacity of 40,000 gallons to store the 40 to 50 percent urea solution. The urea solution would be recirculated in a loop system to ensure proper mixing and temperature is maintained. Heaters would be installed to keep the urea in solution, as urea tends to crystallize out of solution at temperatures below 60°F. An enclosed modular building would be used to house the circulating module. Associated piping would be installed outside the powerhouse at the north end of the booster fan building (see Figure 1-2). Four metering modules, the distribution modules, and the injectors would be located inside the JOF powerhouse.

In operation, the SNCR system would use approximately 4,800 gallons of urea per day, which would be delivered by truck. Approximately seven truck deliveries per week would be required; however, deliveries would normally occur only during the work week. The existing fuel oil unloading area would be used as the delivery point. Urea would be piped from this area to the storage tanks.

2.2. Comparison of Alternatives

Under Alternative A, the No Action Alternative, the SNCR system on Unit 1 would continue operation through 2006, but SNCR would not be installed on Units 2 through 4.

The physical appearance and operation of JOF would remain virtually unchanged. Consequently, NOx emissions would also remain unchanged after 2006. The purpose of the proposed action would not be met under the No Action Alternative.

Under the Action Alternative, SNCR systems would be added to Units 2, 3, and 4, or any combination thereof, and Units 1 through 4 would be operated on a year-round basis. As a result, overall NOx emissions from JOF would be reduced. Construction activities would generate minor amounts of particulate air emissions. Construction is not expected to affect water quality significantly. Because ammonia slip can bind to flyash particles, sluice water would be ammoniated. However, concentrations would be low, and analysis indicates that ammonia concentrations at the outfall would not affect aquatic life, most notably threatened and endangered mussel species, in the Tennessee River. Appropriate measures, such as staging releases from the metal cleaning waste treatment pond, would be taken to ensure that ammonia concentrations remain at low levels. No significant environmental impacts are anticipated under the Action Alternative.

2.3. Preferred Alternative

The preferred alternative is Alternative B. Adoption of the Action Alternative would result in a reduction of NOx in releases from JOF and would aid TVA in meeting its systemwide goal of reducing NOx emissions.

CHAPTER 3

3. AFFECTED ENVIRONMENT

The existing conditions of those environmental resources that could be affected by the proposed action are described in this chapter. Specifically, the resources described include air quality, water quality, solid waste production, aquatic biology, terrestrial biology, wetlands, visual quality, natural areas, and cultural resources. These are described in detail below.

3.1. Air Quality

As stated in the EA for the pilot SNCR project at JOF (TVA, 2005a), the air quality in the vicinity of JOF is generally good, and the area is in compliance with all air quality standards. Regional air quality is also good. The United States Environmental Protection Agency (USEPA) established a new, more stringent 8-hour ozone standard in 1997. Many areas are having difficulty meeting attainment of the new standard. Humphreys County could experience periods with fine particulate concentrations above the recently adopted annual standard for particulates having a diameter of 2.5 micrometers (i.e., $PM_{2.5}$). The USEPA recently proposed that the $PM_{2.5}$ daily exposure standard be reduced from 65 micrograms per cubic meter ($\mu g/m^3$) to 35 $\mu g/m^3$. This proposal is currently under review.

Ozone levels in the TVA region have historically been less than the National Ambient Air Quality Standards (with the exception of a few urban centers). With the recent revision of the ozone standard from a 1-hour average concentration of 120 parts per billion (ppb) to an 8-hour average concentration of 80 ppb, more areas in the TVA region are expected to experience ozone concentrations exceeding the standard.

3.2. Water Quality

3.2.1. Surface Water

The JOF outfalls discharge to the Tennessee River at Tennessee River Mile (TRM) 99.4, 100.2, and 100.4 (future Outfall 011). Water quality in the lower Kentucky Reservoir watershed in the vicinity of JOF is listed on the 2004 TDEC 305(b) list as fully supporting its designated uses (TDEC, 2004a). The only water body in the area on the 2004 303(d) list was Trace Creek, which is approximately 3 miles downstream of the plant (TDEC, 2004b). Trace Creek is on the 303(d) List for siltation, nutrients, low dissolved oxygen, and habitat loss due to a major municipal point source discharge and land development in the area.

JOF has 10 operating pulverized coal-combustion units. These units are expected to burn between 3.9 and 4.2 million tons of coal annually through at least calendar year 2009, resulting in a total annual ash production of approximately 260,000 to 300,000 tons. The four-year annual average fly ash production for individual units at JOF (2001-2004) is approximately 22,500 tons. The fly ash is fine enough and light enough to be entrained in the flue gas stream exiting the boiler. The bottom ash is coarser and heavier and collects in the bottom of the boiler. All the fly ash and bottom ash are wet-sluiced to the ash pond. The coal-combustion byproducts handling system at JOF utilizes a central ash disposal area that receives and treats wastewater effluents.

The JOF ash pond is permitted to receive combined wastewaters of ash transport water, treated chemical and nonchemical metal cleaning wastes, untreated nonchemical metal cleaning wastes (such as APH cleaning wastes), station sump discharges, groundwater flows, coal pile runoff, storm water runoff, and other flows. The ash pond inflow sources and flow rates are listed in Table 3-1. Effluent from the ash pond is discharged to the Tennessee River at TRM 100.2 at a typical rate of 22.8 million gallons per day (MGD) from Outfall 001.

Table 3-1. Inflow Sources to Ash Pond

Source	Inflow to Ash Pond (MGD)
Fly ash sluice water	15.3160
Water treatment plant wastewater	1.8185
Station sumps and nonthermal sump	5.4909
Coal yard drainage pumping basin	0.3318
Metal cleaning waste treatment pond	0.0869
Nonchemical metal cleaning waste	0.0035
Precipitation	0.2352
Proposed dredge pump ash sluice water	- 0.4519
Evaporation	- 0.0670
Total	**22.7639**

Source: Wastewater Flow Schematic NPDES Permit Number TN0005444 effective April 1, 2005

At the ash pond, bottom ash is removed continuously from the ash sluice channel by use of a dragline or a track hoe. Fly ash, which is lighter, is carried past the bottom ash settling area into the main section of the ash pond. The fly ash is removed routinely, and both fly ash and bottom ash are hauled to an off-site disposal area.

The APHs are routinely steam cleaned twice per week, which removes an estimated 10 percent of the material that has accumulated on their interior surfaces (personal communication, Anthony Dillon, TVA JOF, February 18, 2005). The APHs are thoroughly cleaned during unit outages, which occur typically once every three years. Currently, the wastewater generated from cleaning the APHs is discharged directly to the ash pond.

The ash pond effluent limits are set by the current JOF NPDES Permit Number TN0005444, which was effective April 1, 2005. The effluent limits are presented in Table 3-2. These requirements do not include limitations for ammonia concentrations in the effluent, but do include limits for acute toxicity. Within the ash pond, the stilling pond has permanent baffles to increase retention time and mixing. The ash pond is also equipped with a CO_2 system used to regulate pH levels at the discharge to remain in compliance with the NPDES permit limits.

Table 3-2. Discharge Serial Number 001 (Outfall 001) Discharge Requirements

Effluent Characteristics	Effluent Limitations				Monitoring Requirements	
	Monthly Average		Daily Maximum		Measurement Frequency	Sample Type
	Average Concentration (mg/L)	Average Amount (lb/day)	Average Concentration (mg/L)	Average Amount (lb/day)		
Flow	Report (MGD)		Report (MGD)		1/Week	Instantaneous
pH	Range 6.0 – 9.0 (s.u.)				1/Week	Grab
Total Suspended Solids	30.0	--	86.6	--	1/Month	Grab
Oil and Grease	14.0	--	19.0	--	1/Month	Grab
Aluminum (total)	--	--	Report	--	1/Year	Grab
Arsenic (total)	--	--	Report	--	1/Year	Grab
Iron (total)	--	--	Report	--	1/Year	Grab
Lead (total)	--	--	Report	--	1/Year	Grab
Silver (total)	--	--	Report	--	1/Year	Grab
Thallium (total)	--	--	Report	--	1/Year	Grab
Cyanide (total)	--	--	Report	--	1/Year	Grab
48 Hour LC_{50}	Report (serial dilutions)				1/Permit Cycle	Grab

lb/day = pounds per day
LC_{50} = An estimate of the effluent concentration which is lethal to 50 percent of the test organisms in the time period prescribed by the test, expressed as the LC_{50}
MGD = million gallons per day
mg/L = milligrams per liter
s.u. = standard unit
Source: NPDES Permit Number TN0005444 effective April 1, 2005

JOF is authorized by its NPDES permit to discharge chemical and nonchemical metal cleaning wastewaters from the metal waste cleaning pond through internal monitoring point 005 to the ash pond. Historically, both APH wash wastewater and boiler cleaning waste have been discharged to the metal cleaning waste treatment pond. The waste is pumped from the metal cleaning waste treatment pond to the ash pond. The working capacity of the metal waste cleaning pond is estimated to be 4.2 million gallons (personal communication, Anthony Dillon, TVA JOF, February 10, 2005).

3.2.2. Groundwater

Previous subsurface investigations (e.g., Kellberg, 1948; Boggs, 1980; Lindquist et al., 1995), have shown that the JOF site is underlain in descending stratigraphic order by unconsolidated alluvial and residual soil deposits (ranging from Pleistocene to Holocene age), the Fort Payne Formation (Mississippian age), the Chattanooga Shale (Devonian age), and the Camden Chert (Devonian age). Alluvial deposits ranging up to 45 feet in thickness and consisting of heterogeneous lenses and layers of clay, silt, sand, and gravel cover most of the plant site. Residual soils composed primarily of clay and silt are also present in some areas below the alluvial sediments. The Fort Payne Formation is composed of thinly bedded, cherty limestone with occasional clay seams. Thickness of the Fort Payne ranges up to 40 feet along the eastern boundary of the plant reservation, but the formation thins to the west, becoming completely absent over the western part of the reservation. The underlying Chattanooga Shale consists of 25 to 30 feet of black fissile carbonaceous shale. Kellberg (1948) encountered the Chattanooga Shale in thicknesses ranging from 7 to 75 feet across the plant site. Variations in thickness observed in boreholes are attributed to folding and repetition by faulting in the areas where thickness exceeds 30 feet and to partial removal by erosion in areas exhibiting thicknesses less than 30 feet. Below the Chattanooga Shale lies 100 feet or more of the Camden Chert. The Camden is composed of thinly bedded and highly brecciated chert with occasional thin clay seams.

The first occurrence of groundwater beneath the site is within the lower portion of the alluvial and residual overburden. Because these layers are not very thick and because they do not conduct groundwater well, the overburden deposits represent only a marginal aquifer. The Fort Payne Formation is not a usable aquifer in the plant vicinity because of its limited thickness. The Camden Chert represents the principal aquifer in the vicinity and is the source of water for numerous wells in the region. The Chattanooga Shale acts as a groundwater barrier between the Camden aquifer and the overlying overburden and, where present, the Fort Payne Formation. Local groundwater movement at the plant site is generally from east to west toward the Tennessee River. Groundwater recharge occurs by local infiltration of precipitation at ground surface and laterally from upland areas east of the site. Groundwater passing beneath the site ultimately discharges to the Tennessee River.

A well survey (Boggs, 2000) identified nine water wells within 2 miles of the plant. A listing of these wells is provided in the previous EA (TVA, 2005a). DuPont owns six of these wells, five of which are no longer in use. All off-site wells are situated upgradient (i.e., east) of the plant. No public wells or spring water supplies were identified within 2 miles of the site.

3.3. Solid Waste

Total coal ash production ranges from approximately 260,000 to 300,000 tons of ash per year. The ash is collected as either fly ash, which is carried with the flue gas stream exiting the boiler, or as bottom ash, which is coarser and heavier and falls to the bottom of the boiler. By weight, approximately 80 percent of the total ash is fly ash and 20 percent is bottom ash.

All of the fly ash and bottom ash produced at JOF is sluiced to the main ash pond. Because the fly ash is handled wet, it tends to form cakelike masses that are difficult to handle and process. Thus, there are few opportunities for marketing this material.

Bottom ash production ranges from 50,000 to 60,000 tons annually. Most bottom ash reclaimed within the pond is currently used to help prepare cells during the dewatering process. Ultimately, it is hauled off site with the reclaimed fly ash for use as fill material. Small amounts of bottom ash are also used by local counties for snow and ice control on roads during the winter.

3.4. Aquatic Biology

As part of its Vital Signs Monitoring Program (Dycus and Baker, 2001), TVA monitored Kentucky Reservoir annually from 1991 through 1995 to establish baseline data on the reservoir's ecological health under a range of weather and flow conditions. Kentucky is now monitored every other year. The ecological health of Kentucky Reservoir was rated as good in 2003. Since 1991, the rating for Kentucky has been either fair or good, with only small changes among indicators. The fish community rated good at the forebay (i.e., the deepwater portion of the reservoir immediately upstream of the dam) and at midreservoir monitoring locations and fair at the Big Sandy embayment and inflow. Prior to 2001, the fish community typically rated fair at all locations. In 2001 and 2003, a larger number and variety of fish were collected at the forebay and midreservoir than in previous years, resulting in good ratings.

Kentucky Reservoir supports a fairly diverse freshwater mussel community, and commercial mussel fishing is allowed in the vicinity of JOF. A review of the TVA Natural Heritage database indicated that three federally and state-listed endangered mussel species are historically known to occur in the main channel of the Tennessee River (Kentucky Reservoir) adjacent to JOF. These mussels are the pink mucket (*Lampsilis abrupta*), the rough pigtoe (*Pleurobema plenum*), and the orangefoot pimpleback (*Plethobasus cooperianus*). The pink mucket is the only listed aquatic species to be collected recently from the area. Rough pigtoe and orangefoot pimpleback are not likely to occur in the vicinity of JOF. No other federally listed or state-listed aquatic animal species are known to occur in the vicinity.

3.5. Terrestrial Biology

The proposed actions would take place within the JOF industrial complex. Plans include placing urea tanks in an area that is primarily bare ground with small patches of weedy vegetation. This area has experienced heavy human disturbances associated with previous construction and operation of the facility. The proposed project would involve less than an acre of open area. Because of the industrial nature of the site and extensive past disturbance, the area is of little value to wildlife. Ash ponds contain open water with emergent vegetation along the edges. They provide habitat for red fox and some aquatic birds such as ducks, geese, and herons.

A review of the TVA Natural Heritage database indicated there are 10 state-listed plant species known from Humphreys County, Tennessee (see Appendix A). TVA biologists conducted a field survey of the project area in January 2006. No federally listed or state-listed plant species were identified on the site during that survey. No designated critical plant habitat was present within the project area.

The database review also indicated that 13 listed terrestrial animal species are reported from Benton and Humphreys Counties, Tennessee (see Appendix B). Two of these, the bald eagle and the gray bat, are federally listed. Additionally, three heronries and four caves are known to exist in Benton and Humphreys Counties, Tennessee. However, no federally listed or state-listed terrestrial animal species were observed during field investigations of JOF in 2005 and 2006.

Suitable habitat for the eastern hellbender, anhinga, Bewick's wren, Allegheny woodrat, southeastern shrew, meadow jumping mouse, northern pine snake, and the western pigmy rattlesnake is not present on the project site. A great egret heronry is located approximately 5 miles south of JOF. A colony of little blue herons approximately 2 miles from JOF is no longer active, based on field surveys performed in 2005. Alligator snapping turtles are known to inhabit the Tennessee River near JOF.

Bald eagles nest near large bodies of water including lakes, rivers, and riparian wetlands. No bald eagle nests were observed at JOF during preliminary field investigations on September 15, 2005. The closest known eagle nest site is approximately 4.4 miles from JOF at Tennessee National Wildlife Refuge. The eagles no longer nest at their original site but have moved to an area along the mouth of the

Duck River. Several additional bald eagle pairs have recently moved into the vicinity of the Duck River. Although no nests are known from the immediate vicinity surrounding JOF, suitable nesting habitat exists along the Tennessee River and associated embayments near JOF.

Gray bats roost in caves during all seasons and typically forage over open water. No caves used by gray bats are known from the Humphreys or Benton county area. The only record known from the area is of a single bat in Camden, which is approximately 6.5 miles from the project site. Due to the presence of gray bats upstream from the project site, they likely forage along the Tennessee River and associated embayments near JOF.

3.6. Wetlands

A review of National Wetland Inventory data did not indicate wetlands in the project area. An on-site survey of the project area was conducted on January 25, 2006. No jurisdictional wetlands (i.e., those wetlands that are regulated under the Clean Water Act) were found in the vicinity. On-site ditches and ponds, including the ash pond, provide some wetland functions. Because these features are part of a wastewater treatment system designed to meet NPDES requirements, they are not considered “waters of the U.S.” and are not subject to regulation under Section 404 of the Clean Water Act.

3.7. Managed Areas

A review of the TVA Natural Heritage database indicated that the proposed activity is within 3 miles of four managed areas or ecologically significant sites. These areas include the Camden Wildlife Management Area and two land tracts of Nathan Bedford Forrest State Park: Johnsonville State Historic Area and Eva Park.

The 3,682-acre Camden Wildlife Management Area, located approximately 1.0 mile southwest of JOF, is managed by the Tennessee Wildlife Resources Agency for waterfowl. Nathan Bedford Forrest State Park, managed by TDEC, includes over 3,000 acres in tracts on both sides of Kentucky Reservoir. The Johnsonville State Historic Area, a 500-acre tract on the east side of Kentucky Reservoir, preserves Civil War earthworks and the historic significance of the area as a Civil War battle site, as well as the old town of Johnsonville, which was mostly covered by the creation of Kentucky Reservoir by TVA in 1944. This tract is approximately 1.5 miles northeast of the proposed activity. Eva Park, located approximately 2.0 miles northwest of JOF on the west side of Kentucky Reservoir, features a lakeside beach and boat ramp.

No streams listed on the Nationwide Rivers Inventory are located within 3 miles of the proposed activity.

3.8. Cultural Resources

The project Area of Potential Effect was determined as all areas in which land-disturbing activities would take place, which include the proposed construction of two permanent 40,000-gallon storage tanks. A literature search and a Phase I survey, conducted on January 18, 2006, revealed no evidence of archaeological deposits or significant architectural resources within the project area (Deter-Wolf, 2006). The findings of the survey were coordinated with the Tennessee State Historic Preservation Officer.

CHAPTER 4

4. ENVIRONMENTAL CONSEQUENCES

In this chapter, the potential environmental effects of implementing each of the alternatives are described. The order with respect to affected resources is the same as in the previous chapter.

4.1. Air Quality

4.1.1. Alternative A – The No Action Alternative

Under Alternative A, current air quality in the vicinity of JOF is expected to remain virtually unchanged. There would be no construction-related effects to air quality. Reduction in NOx emissions are expected to continue for the duration of the SNCR demonstration project on Unit 1. However, because the proposed action would not be undertaken, there would be no additional reduction in NOx emissions from JOF.

4.1.2. Alternative B – The Action Alternative

4.1.2.1. Construction Impacts

Under Alternative B, some transient air pollutant emissions would occur during the construction phase of this project. Construction-related air quality impacts are primarily related to land clearing, site preparation, and the operation of internal combustion engines. A minor amount of site disturbance would occur during site preparation for the urea storage tank and new compressor building.

Vehicle Emissions and Excavation Dust

Land clearing, site preparation, and vehicular traffic over unpaved roads and construction sites can result in the emission of fugitive dust particulate matter (PM). The largest-size fraction (greater than 95 percent by weight) of fugitive dust emissions would be deposited within the construction site boundaries. The remaining fraction of PM would be subject to longer-range transport. If necessary, open construction areas and unpaved roads would be sprinkled with water to reduce fugitive dust emissions.

Combustion of gasoline and diesel fuel by internal combustion engines (e.g., vehicles, generators, construction equipment, etc.) would generate local emissions of PM, NOx, carbon monoxide, volatile organic compounds (VOCs), and sulfur dioxide throughout the site preparation and construction period. These emissions would be minor and would result in minimal off-site impacts due to the short construction period and the limited need for heavy construction equipment.

Air quality impacts from construction activities would be temporary and would be dependent on both man-made factors (e.g., intensity of activity, control measures, etc.) and natural factors (e.g., wind speed, wind direction, soil moisture, etc.). However, even under unusually adverse conditions, these emissions would have, at most, a minor, temporary impact on off-site air quality that would not exceed or violate any applicable ambient air quality standard. Overall, the potential effects to air quality from construction-related project activities would be minor and insignificant.

4.1.2.2. Operational Impacts

Operation of JOF under Alternative B would not adversely impact local air quality. There would be the possibility of slight increases in ammonia concentrations downwind of the plant site as a result of ammonia slip in stack emissions and from marginal volatization of ammonia from the ash pond. These ammonia emissions would have a minor and insignificant effect on air quality. Overall, operation of Units 1-4 with the SNCR would improve air quality.

Plume Opacity

The opacity of the plume coming from the stack is determined by the amount of nitrogen dioxide, SOx, ammonia, and PM emitted. Adoption of the Action Alternative would remove some NOx and a lesser amount of sulfur trioxide. Total ammonia emissions due to slip would likely increase. The stack plume opacity would be assessed to verify compliance with the applicable standards. If ammonia slip is identified as a major contributing factor to higher opacity, urea feed rates would be adjusted accordingly to reduce opacity (see Section 4.11.1).

4.1.2.3. Regional impacts

Ozone

Ozone forms in the atmosphere as a result of a mixture of NOx and VOCs being exposed to sunlight. Both NOx and VOCs have natural and man-made emissions sources. For example, isoprene (a VOC important in ozone formation) is emitted primarily from trees and agricultural crops. Other VOCs, however, are emitted into the atmosphere as a result of human activity, such as the use of solvents or the operation of motor vehicles. Although there are also natural sources of NOx, they are relatively small compared to the NOx emitted from motor vehicles and other forms of fuel combustion. Because utility boilers burn large quantities of fossil fuel, they are a major source of the NOx emitted into the atmosphere.

Air quality research indicates that the overall effect of the operation of SNCR on four units at JOF would be a regional reduction in the amount of ozone produced in the atmosphere. The area that would benefit the most would be the area within about 90 to 95 miles downwind from JOF.

Secondary Particulate and PM_{10}/$PM_{2.5}$ and Regional Haze

Almost all of the urea used in the SNCR would be converted to nitrogen and water by the chemical reactions mentioned previously (see Section 1.2.1). However, because of ammonia slip, there is a possibility that some ammonia could be emitted from the stack. Ammonia is associated with the formation of particulate in the atmosphere. Because ammonia is ubiquitous in the atmosphere, any additional contribution to PM and haze from JOF's ammonia emissions would be minor and insignificant.

4.2. Water Quality

4.2.1. Alternative A – The No Action Alternative

Under this alternative, TVA would continue the NOxOUT® SNCR demonstration on JOF Unit 1. Also, if this alternative were adopted, no new SNCR-related construction would occur; thus, there would be no construction-related effects to surface water or to groundwater. No impacts to surface waters are anticipated beyond the effects of existing and future activities associated with routine operation of the plant. Similarly, there would be no effects to groundwater resources beyond those associated with waste disposal operations under this alternative.

4.2.2. Alternative B – The Action Alternative

4.2.2.1. Construction Impacts

No impacts to surface water are expected as a result of construction and installation of the SNCR equipment, storage tanks, and related systems. JOF is an industrial facility with existing best management practices (BMPs) in place. Additional BMPs to prevent erosion and the discharge of sediment or other polluting materials in the runoff to surface waters in the JOF Integrated Pollution Prevention (IPP) Plan would also be implemented. All construction activities would be conducted in a manner that ensures waste materials would be contained and no pollutants would be introduced to the receiving stream.

Portable toilets or existing facilities would be available to the construction workforce. Portable toilets would be serviced regularly, and the sewage would be transported by tanker truck to a publicly owned treatment facility. Thus, any potential effects to surface water or groundwater quality from the proposed construction activities at JOF are expected to be minor and insignificant.

4.2.2.2. Operational Impacts – Surface Water

No significant impacts to surface water are anticipated due to spills or leaks. The urea storage tanks either would be placed within secondary containment or would be double-walled tanks having interstitial monitoring equipment installed to detect leaks. Optionally, diversionary containment would be installed. Tanker truck deliveries would be made to the fuel oil unloading area, and urea would be piped to the storage tanks. The fuel oil unloading area is a curbed concrete pad with a valve and a sump. During the transfer of urea from tanker truck to holding tank, all normal BMPs would be applied to the unloading operation. All Department of Transportation requirements would be followed. The driver would be within 25 feet of the truck, alert, have an unobstructed view of the tanker, and be able to move the tanker should an emergency situation require it to be moved.

Leaks or spills from the piping inside the powerhouse would be routed to the ash pond via the station sump. The outside piping between the tank and the powerhouse would be short sections, which should minimize the risk for leaks to occur there. To reduce the risk of a leak in the outside piping further, the piping would be welded.

Ammonia Slip

As stated in Section 1.2, the SNCR system is an in-furnace, post-combustion NOx reduction technology that relies on the finely controlled distribution of urea to cause a selective reaction of gas-phase ammonia with NOx. Ammonia slip, the emission of unreacted ammonia, is caused by the incomplete reaction of the ammonia with NOx present in the flue gas. The unreacted ammonia can adhere to or commingle with the fly ash and subsequently build up on the APH interior surfaces. The ammonia could react with available gaseous sulfuric acid to form ammonium bisulfate, a very sticky substance. Formation of ammonium bisulfate could accelerate the buildup inside the APHs and make the periodic cleaning of the APHs more difficult.

European experience with selective catalytic reduction (SCR) systems at facilities using low-sulfur coals led to a recent study that concluded that about 20 percent of the NH_3 slip adhered to the heating surfaces in the APH, and about 80 percent adhered to the fly ash (ABB Environmental, 2000). No known ammonia partitioning study for SNCRs has been performed. For this EA, the ammonia partitioning was assumed to be similar to the ABB SCR study, which is a conservative approach.

The actual amount of ammonia slip would depend on unit operation. Because there would be no catalyst subjected to fouling, the slip rate was assumed to be constant during SNCR operations unless the urea injection rate changed.

Bottom ash sluice water is not affected by ammonia slip. The bottom ash is collected in the bottom of the boiler prior to the point where the urea is injected. Therefore, any ammonia slip would be entrained in the flue gas and would have no contact with the bottom ash.

Ammonia Loading to the Ash Pond

Ammonia Criteria

The current JOF NPDES permit requirements for the Outfall 001 discharge do not include limitations for ammonia concentrations; however, acute toxicity testing and reporting are required, and there are existing water quality criteria for ammonia. The acute criterion (criterion maximum concentration or “CMC”) for protection of aquatic life ammonia toxicity is defined as the 1-hour average concentration of total ammonia nitrogen (in milligrams of nitrogen per liter) that should not be exceeded more than once every three years on average. The CMC applies after mixing with the receiving stream and beyond a reasonable zone of immediate effect (i.e., mixing zone). If the effluent concentration approaches the CMC, this would raise concerns about compliance with the acute toxicity limit for the ash pond outfall. In addition, the NPDES permit may be modified to include limits or action levels for ammonia nitrogen.

Table 4-1. Maximum Allowable Ammonia Concentrations to Protect Aquatic Life From Acute Effects at Typical pH Levels

Acute Criterion (mg NH_3-N/L)						
pH 6.0	**pH 6.5**	**pH 7.0**	**pH 7.5**	**pH 8.0**	**pH 8.5**	**pH 9.0**
54.99	48.83	36.09	19.89	8.41	3.20	1.32

Note: Assumes salmonids are absent

Similarly, the chronic criterion concentration (CCC) for ammonia must be met in the receiving stream to protect the aquatic life of the Tennessee River. The CCC is defined as the 30-day average concentration not to be exceeded more than once every three years. In addition, the highest 4-day average concentration within the 30-day period should not exceed 2.5 times the CCC. The CCC is dependent on both temperature and pH. As temperature and/or pH increases, the CCC decreases (see Table 4-2).

Table 4-2. Thirty-Day Average Allowable Ammonia Concentrations to Protect Aquatic Life From Chronic Effects at Selected pH Levels

Chronic Criterion Concentration (CCC) - mg NH_3-N/L				
Temperature (°F)	**pH 7.5**	**pH 8.0**	**pH 8.5**	**pH 9.0**
70	2.85	1.59	0.71	0.32
75	2.38	1.33	0.6	0.27
80	1.99	1.11	0.5	0.22
85	1.67	0.93	0.42	0.19
90	1.39	0.78	0.35	0.16
95	1.17	0.65	0.29	0.13
100	0.97	0.54	0.24	0.11
105	0.81	0.45	0.20	0.09

Note: Assumes salmonids are absent

Ammonia in the ash pond could possibly cause rapid algae growth (i.e., an "algae bloom") under certain conditions. Such an occurrence could increase the pH of the ash pond and alter the CCC. In the event of an algae bloom, several options are available. Appropriate chemical or mechanical control measures would be taken to control algae blooms as necessary.

Fly Ash Sluice Water Loading

Ammoniated fly ash would be wet sluiced to the ash pond during normal SNCR operation. The fly ash is assumed to mix completely with the ash pond inflow. In addition, no volatilization, chemical degradation, or biological uptake of the ammonia was assumed for the purposes of estimating the ammonia discharge. In fact, some ammonia is lost to volatization, is broken down chemically, and is taken up by plants. However, because these amounts are small and could not be quantified accurately, these amounts were assumed to be zero for the purposes of TVA's analysis.

The permissible pH range for the Outfall 001 discharge is 6.0-9.0 standard unit (s.u.), which corresponds to a CMC range of 54.99 to 1.32 milligrams (mg) ammonia nitrogen per liter (NH_3-N/L) (see Table 4-1). Using a 5 parts per million by volume (ppmv) slip rate and assuming all of the ammoniated steam cleaning waste from the twice weekly APH cleanings is being discharged to the ash pond simultaneously, the ammonia concentration at Outfall 001 is calculated to be 1.844 mg NH_3-N/L. Given an ammonia concentration of 1.844 mg NH_3-N/L, the pH would have to be adjusted to 8.8 s.u. or lower to meet the CMC value at the effluent. Similarly, assuming the same conditions with a slip rate of 10 ppmv (a level twice the expected slip rate), the pH would have to be adjusted to 8.42 or less to meet the CMC value at the point of discharge. The impact of the ammoniated discharge produced by the sluiced fly ash and APH steam cleaning waste loading to the ash pond during normal operation of the SNCRs is determined to be insignificant only if the ammonia concentration discharged from Outfall 001 does not exceed the CMC value. Although from a regulatory standpoint, the CMC is an in-stream criterion, it is being used as an indicator for effluent acute toxicity.

For the period of January 1, 1986, through January 17, 2006, the highest recorded intake temperature at JOF was 90.4°F, and the highest recorded discharge temperature was 102.0°F. Assuming a water temperature of 93.2°F and pH of 9.0 s.u., the CCC for ammonia would be 0.14 mg NH_3-N/L (see Table 4-2). The ammonia slip rate would have to be greater than 53 ppmv to exceed an ammonia concentration of 0.09 mg NH_3-N/L in the Tennessee River during 1Q10 low flow conditions (4,989 MGD). A slip rate as high as 53 ppmv is extremely unlikely, as optimum performance of the JOF Unit 1 SNCR during the 2005 ozone season demonstration was achieved with a slip rate of 5 ppmv or less (TVA, 2005b). The ammonia loading from the sluiced fly ash and ammoniated APH steam cleaning waste discharged to the ash pond during normal operation of the SNCRs is expected to meet the CCC limits; therefore, no significant impact to surface water quality is expected.

<u>APH Cleaning Wastewater Loading</u>
The largest ammonia loading to the ash pond would come from the APH cleanings during unit outages, assuming the wastewater would be discharged directly to the ash pond, as is the current procedure. A commitment was made in the previous EA (TVA, 2005a) to activate mitigation measures as needed to ensure that all NPDES permit and other regulatory requirements for Outfall 001 are met. Such measures include staging releases of the APH wastewater, improving ash pond mixing, or using other mitigation options. These same measures would be used when operating the four SNCR systems year-round at JOF to prevent any significant impacts to surface water (see Section 4.11.1 and Appendix D).

4.2.2.3. Operational Impacts – Groundwater

Disposal of ammoniated ash and APH wash water in Ash Pond D would result in circulation of ammonia-laden sluice water through the pond. The majority of ammoniated sluice water (i.e., approximately 15.3 MGD of a total daily inflow to the pond of 22.8 MGD) would discharge at pond Outfall 001, while a small portion would infiltrate into the unconsolidated soil fill and alluvial deposits beneath the pond. Because the ash pond is situated on an island artificially created within the reservoir, any pond seepage entering the underlying groundwater system would ultimately discharge as seepage into the Tennessee River. No off-site transport of ammoniated groundwater from the ash pond to adjacent property would occur. Consequently, there would be no impacts to existing or future groundwater users in the vicinity.

Effects of ammoniated-leachate seepage on river water quality would be negligible. Betson et al. (1986) conservatively estimated the seepage rate from Ash Pond D to the reservoir to be approximately 0.075 MGD. This represents approximately 0.4 percent of the average discharge (22.8 MGD) from Outfall 001. The additional ammonia loading produced by leachate seepage would be negligibly small in comparison to normal ash pond ammonia loadings, which are expected to meet aquatic criteria under 1Q10 flow conditions (see Section 4.2.2.2).

4.3. Solid Waste

4.3.1. Alternative A – The No Action Alternative

Under this alternative, TVA would continue to operate the SNCR on JOF Unit 1 for the remainder of the demonstration period. No impacts to solid waste are anticipated beyond the effects of existing and future activities associated with routine operation of the plant.

4.3.2. Alternative B – The Action Alternative

Implementation of the proposed activities would not result in the generation of additional ash. However, as stated in Section 4.2.2, ammonia slip can be adsorbed by particles of fly ash.

Potential impacts of ammonia slip as a result of the SNCR installation on Units 1 through 4 at JOF would be that ammonia levels present on the fly ash could be up to 500 parts per million deposited on the fly ash (TVA, 2005b). Because ammonia on fly ash would be highly water soluble, all of this ammonia would likely dissolve into the sluice water as the ash is pumped to the ash pond. Due to the alkaline pH of the fly ash and sluice water, some ammonia may volatilize at the ash pond (see Section 4.1.2.2). However, ammonia would be completely flushed or volatilized from any ash destined for off-site use or disposal. Because bottom ash is collected in the boiler prior to urea injection, it would not be subject to ammonia contamination.

4.4. Aquatic Biology

4.4.1. Alternative A – The No Action Alternative

Under the No Action Alternative, additional NOx emission reduction equipment would not be installed. The SNCR on Unit 1 would continue operations during 2006. Thus, no impacts to aquatic life, including threatened or endangered aquatic species, would occur under the No Action Alternative.

4.4.2. Alternative B – The Action Alternative

4.4.2.1. Construction Impacts

Under Alternative B, potential construction impacts to the Tennessee River (Kentucky Reservoir) would include temporary erosion and siltation resulting from construction of the SNCR systems, primarily the installation of the urea storage tanks and the circulation module. These areas have been disturbed previously by plant construction and modification activities. In addition, the area subject to disturbance would be small, and any soil disturbance would be localized. Potential construction impacts would be minimized by implementing BMPs to control erosion during construction, stabilizing disturbed areas after completion of construction, and routing surface runoff to existing treatment facilities that meet regulatory requirements (see Section 4.2.2.1). Implementation of these measures would substantially reduce the potential impacts in the Tennessee River to the point of causing only minor and temporary effects on fish and other aquatic life. Construction activities would cause no impacts to protected aquatic animals or their habitats in the Tennessee River.

4.4.2.2. Operational Impacts

The storage, handling, and use of urea solutions for the proposed SNCR project could potentially contaminate surface water and impact aquatic life, mainly by means of an accidental release of urea to surface water. To reduce this potential, the urea storage system would use either a double-wall tank with a leak-detection system or a secondary containment system. In addition, other spill prevention safeguards would be implemented (see Section 4.11.1). Because of the implementation of spill prevention safeguards and because the likelihood of accidental releases of contaminants is remote, adverse effects to aquatic life from spills are not anticipated.

The presence of ammonia in the industrial wastewater stream is another potential source of adverse effects to aquatic life. The maximum allowable ammonia concentrations (i.e., the CMC) set by USEPA range from 54.99 to 1.32 mg NH_3-N/L, depending on pH (see Table 4-1). Similarly, the CCC values range from a high of 2.85 NH_3-N/L to a low of 0.09 NH_3-N/L (see Table 4-2). These values are dependent on temperature and pH. The criterion for CMC becomes more stringent with increasing pH, while the criterion for CCC becomes more stringent with increasing temperature and pH.

The average discharge flow from Outfall 001 is very small compared to the average flow in the Tennessee River in the vicinity of JOF—roughly a 1:200 ratio. At a slip rate of 5 ppmv, the concentration of ammonia in the river, after mixing with the flow of the river, was calculated to be 0.008415 mg NH_3-N/L. For a slip rate of 10 ppmv, which is unlikely, the calculated ammonia-nitrogen concentration in the river after mixing is 0.017 mg NH_3-N/L. The estimated ammonia concentration at either slip rate is much lower than the most stringent CCC (0.09 NH_3-N/L) (see Table 4-2). As an additional safeguard, the APH wash wastewater would be contained and released in a manner that would ensure that the CMC would be met (see Section 4.2.2.2).

Freshwater mussels are typically more sensitive to toxicants than many aquatic species. Recent studies (Mummert et al., 2003; Newton et al., 2003; and Bartsch et al., 2003) indicate that freshwater mussels can be adversely affected at lower concentrations of ammonia than those allowed under the current USEPA criteria, i.e., the CMC or the CCC. Augspurger et al. (2003) suggest that even lower ammonia CCC concentrations (0.3 to 0.7 milligrams per liter [mg/L] total ammonia, at pH 8.0 and temperature of 25 degrees Celsius [°C]) are more appropriate values that would afford protection to mussels. By meeting the USEPA CMC criterion at the ash pond outfall, ammonia levels in the river after mixing would be substantially lower than the CCC criteria suggested by Augspurger et al. (ibid).

No significant impacts to the water quality of the Tennessee River are anticipated, as discharges from the ash pond are required to meet the acute criterion for ammonia and the NPDES permit limits. Ammoniated leachate seepage from the ash pond is very low (see Section 4.2.2.3); thus, potential effects to surface water quality from seepage would be negligible. Thus, operation of the SNCR systems on Units 1 through 4 at JOF would not result in impacts to aquatic resources (i.e., fish or benthic macroinvertebrates in the Tennessee River (Kentucky Reservoir). With the mitigation safeguards listed in Section 4.11 and Appendix D in place to control ammonia in the discharge water, there would be no direct or indirect impacts to individuals or populations of the pink mucket. In a letter of May 17, 2006, the U.S. Fish and Wildlife Service (USFWS) concluded that the proposed action is “not likely to adversely affect” the federally endangered pink mucket (see Appendix C).

4.5. Terrestrial Biology

4.5.1. Alternative A – The No Action Alternative

Adoption of the No Action Alternative would not result in any project-related impacts to the terrestrial ecology of the region, nor would it cause the introduction or spread of invasive terrestrial plant species. No project-related impacts to rare plant species would result from adoption of the No Action Alternative.

Under the No Action Alternative, no changes would be made to wildlife habitat; thus, common wildlife and their habitat would not be affected. For similar reasons, there would be no effect to terrestrial threatened and endangered animals.

4.5.2. Alternative B – The Action Alternative

Because of previous site disturbance and the fact that the work would occur within the JOF plant site, construction and operation of the SNCR system would not affect any common plant communities. These actions would not facilitate the introduction or spread of invasive terrestrial plant species. Similarly, common wildlife habitat would not be altered, and there would be no effect to common terrestrial wildlife or their habitats under the Action Alternative.

No federally listed or state-listed plant species were encountered in the proposed project area. Thus, there would be no effects to any listed plant species under the Action Alternative.

Bald eagles have been sighted from JOF, although no nesting is known to occur within 4 miles of the plant. Due to the localized nature of the proposed actions and the lack of nesting in the area, adoption of the Action Alternative would not affect bald eagles. Gray bat foraging habitat would not be affected under the Action Alternative. The closest known cave used by gray bats is over 20 miles away from the project site. Thus, there would be no effects to gray bats from the proposed actions. The USFWS concurred with this “no effect” determination in a letter of May 17, 2006 (see Appendix C).

4.6. Wetlands

4.6.1. Alternative A – The No Action Alternative

Because there would be no change from the current situation, there would be no additional effects to wetlands under this alternative.

4.6.2. Alternative B – The Action Alternative

Construction and installation of the urea storage tanks, circulating module, and piping would not affect any wetlands. A slight increase in ammonia concentrations in the fly ash sluice water flowing into the ash pond would tend to fertilize the vegetation, including algae, in the ash pond. Because the purpose of the proposed project is to reduce NOx emissions from existing units and because use of nonammonia-based technologies is not feasible, there is no practicable alternative. However, the net effect to vegetation and any wetland functions of the ash pond is expected to be minor and insignificant because the ammonia concentrations in the fly ash sluice would be minimized. Thus, the proposed action is consistent with Executive Order 11990 Protection of Wetlands.

4.7. Managed Areas

4.7.1. Alternative A – The No Action Alternative

Adoption of the No Action Alternative would not affect any local natural areas or streams on the Nationwide Rivers Inventory.

4.7.2. Alternative B – The Action Alternative

No direct, indirect, or cumulative effects to managed areas are anticipated as a result of implementing the proposed action because of the distance (greater than 1.0 mile) from the proposed action to the managed areas identified in Section 3.8. There are no streams listed on the Nationwide Rivers Inventory in the area; thus, there would be no effect to such steams.

4.8. Cultural Resources

4.8.1. Alternative A – The No Action Alternative

Because there would be no change from the current condition at JOF, adoption of the No Action Alternative would not affect any historic resources.

4.8.2. Alternative B – The Action Alternative

Following a survey of the historical and cultural resources of the JOF site, TVA determined that the proposed undertaking would have no effect on any archaeological or architectural resources. In a letter of February 1, 2006 (see Appendix C), the Tennessee State Historic Preservation Officer concurred that the proposed undertaking would not have the potential to affect any historic properties that are potentially eligible or currently listed on the National Register of Historic Places.

4.9. Other Environmental Consequences

Due to the nature of the proposed action, some environmental resources that are frequently considered in environmental reviews would not be affected. Because all activities would be inside the JOF site, no prime farmland would be affected. Likewise, the proposal would not conflict with local land use. The project does not involve the interbasin transfer of water, nor would it interfere with navigation. There would be no disproportionate effects to any minority or economically disadvantaged populations. JOF is not in a floodplain; therefore, the Action Alternative is consistent with EO 11988.

Construction activities would generate some solid waste in the form of construction debris; however, the volume of this material would not affect local landfill capacity. Approximately seven trucks of urea would be delivered per week, during weekdays. This additional truck traffic would not affect local traffic flow. There would be some temporary minor, insignificant visual effects during construction. However, the operational SNCR system would be visually consistent with the industrial character of the JOF site, and potential aesthetic effects would be minimal and insignificant.

4.10. Cumulative Effects

4.10.1. Alternative A – The No Action Alternative

Under this alternative, after 2006, TVA would continue to operate JOF but without the NOxOUT® SNCR demonstration on Unit 1, and TVA's goal to reduce NOx emissions from its coal-fired power plant by 75,000 tons during the ozone season beginning in 2006 would not be achieved. To meet Clean Air Act Title IV requirements, low-NOx burners have already been installed on 34 TVA boilers; staged over-fire air has been installed on 6 units; and combustion optimization has been installed on an additional 18 units. If the SNCR demonstration does not take place, further reductions in NOx would not be achieved. However, TVA would still meet all appropriate regulatory requirements.

4.10.2. Alternative B – The Action Alternative

TVA has installed, is in the process of installing, or is considering the installation of additional NOx controls, using SCR, SNCR, or other NOx reduction technologies, at nine other coal-fired power plants (Allen, Bull Run, Colbert, Cumberland, John Sevier, Kingston, Paradise, Shawnee, and Widows Creek). All units being considered, including those proposed at JOF, are listed in Table 4-3. This strategy supports TVA's systemwide goal of reducing NOx emissions. Overall, TVA's NOx reduction strategy would decrease ozone in the ambient atmosphere.

Table 4-3. TVA Fossil Plant Units With Selective Catalytic Reduction Systems or Other NOx Reduction Technologies Installed or Planned for Installation

Unit	State	Generation Capacity (megawatts)	Year Installed or Estimated to be Completed
Paradise 2	Kentucky	704	2000
Paradise 1	Kentucky	704	2001
Paradise 3	Kentucky	1,050	2003
Allen 2	Tennessee	330	2002
Allen 3	Tennessee	330	2002
Allen 1	Tennessee	330	2003
Widows Creek 7	Alabama	575	2003
Widows Creek 8	Alabama	550	2004
Cumberland 1	Tennessee	1,300	2003
Cumberland 2	Tennessee	1,300	2004
Bull Run	Tennessee	950	2003
Kingston 1-4, 7-8	Tennessee	1,300	2004
Kingston 5-6	Tennessee	400	2005
Colbert 5	Alabama	500	2004
Colbert 1-4	Alabama	800	2011
John Sevier 1-4	Tennessee	800	2008
Johnsonville 1	Tennessee	125	2005
Johnsonville 2-4	Tennessee	375	2009
Shawnee 1	Kentucky	175	2005

The new controls would help reduce local and regional ozone levels and would help prevent violations of the new more stringent 8-hour ozone standard promulgated by USEPA in 1997. The strategy is also consistent with the types of controls that would be needed to comply with USEPA's proposed rule for ozone transport, known as the Ozone Transport State Implementation Plan call.

NOx emitted into the atmosphere leads to the formation of ozone and fine particulate and contributes to increased acidity of precipitation. Thus, the cumulative impact on air quality (due to a reduction in NOx emissions) would be beneficial.

4.11. Commitments and Mitigation

4.11.1. Routine and Compliance Measures

The following measures, which are routine practice or required by regulations would be implemented to reduce the potential for adverse environmental effects.

- Consistent with the JOF Integrated Pollution Prevention Plan, TVA would implement BMPs as necessary to control erosion and fugitive dust during construction, to stabilize disturbed areas after completion of construction, and to route surface runoff to existing treatment facilities that meet regulatory requirements.

- One of three options would be utilized to control spills and leaks from the urea storage tanks: (1) the tanks would be placed within secondary containment, (2) double-walled tanks with interstitial monitoring would be used, or (3) diversionary containment would be implemented.

- Appropriate BMPs would be used during the transfer of urea from tanker truck to the holding tank, and Department of Transportation requirements would be followed.

- The existing CO_2 system or other feasible and effective measures would be utilized to regulate the pH of the ash pond discharge to meet the NPDES permit limits for both pH and acute toxicity and to ensure that the effluent would not exceed the specific limits for ammonia.

- Measures such as staging releases of the APH wastewater, improving ash pond mixing, or other appropriate techniques would be used to ensure that all NPDES permit and regulatory requirements for Outfall 001 are met.

- As part of TVA's ongoing regular stack monitoring, stack plume opacity would continue to be assessed for compliance with applicable standards. If ammonia slip is identified as a major contributing factor to higher opacity, urea feed rates would be adjusted accordingly to reduce opacity.

4.11.2. Special Mitigation Measures

The following action would be taken to reduce the potential for adverse effects to surface water.

- A monitoring, sampling, and reporting plan would be developed and implemented (see Appendix D – Sampling Plan for Johnsonville Fossil Plant SNCR Operation – Units 1-4). This plan specifies responsible personnel, procedures for collecting water samples and fly ash samples, sampling locations, recording procedures, and notification procedures.

CHAPTER 5

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Corita A. Wallace

Position:	Project Control Specialist, TVA Environmental Stewardship and Policy, Chattanooga, Tennessee
Involvement:	NEPA Coordination

CHAPTER 6

6. LIST OF AGENCIES AND PERSONS CONSULTED

Federal Agency

U. S. Fish and Wildlife Service, Cookeville, Tennessee

State Agencies

Tennessee Department of Environment and Conservation, Water Division, Nashville, Tennessee

Tennessee State Historic Preservation Officer, Nashville, Tennessee

CHAPTER 7

7. SUPPORTING INFORMATION

7.1. Literature Cited

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7.2. Abbreviations, Acronyms, and Symbols

<	Symbol for less than
>	Symbol for more than
>=	Symbol for greater than or equal to
$\mu g/m^3$	Symbol for microgram per cubic meter
°C	Symbol for degree Celsius
°F	Symbol for degree Fahrenheit
1Q10	Acronym for the lowest 1-day average flow that occurs (on average) once every 10 years
alluvial	A type of soil deposited by running water
ammonium bisulfate	A compound (NH_4HSO_4) formed by the reaction of ammonia, sulfur oxides, and hydrogen in the flue gas stream
APH	Acronym for air preheater
BMP	Acronym for best management practice
benthic	Bottom dwelling
brecciated	Consisting of sharp fragments embedded in a fine-grained matrix (like sand or clay)
carbonaceous	Carbon-like or containing carbon
CCC	Acronym for chronic criterion concentration, the 30-day average concentration of a pollutant in ambient water that should not be exceeded more than once every three years on the average
chert	a hard, dark, very fine-grained rock composed of silica, of which flint is a nodular form
CMC	Acronym for criterion maximum concentration, the 1-hour average concentration of a pollutant in ambient water that should not be exceeded more than once every three years on average
CO_2	Chemical symbol for carbon dioxide
EA	Acronym for Environmental Assessment
ESP	Acronym for electrostatic precipitator
et al.	Latin term, *et alii* (masculine), *et aliae* (feminine), or *et alia* (neuter) meaning “and others”
fissile	Capable of being split or divided in the direction of the “grain”
forebay	That portion of a reservoir immediately upstream of the dam
gram	Metric unit of mass equal to 0.0352736 ounces
i.e.	Latin term, *id est*, meaning “that is”
JOF	Acronym for Johnsonville Fossil Plant
km	Metric symbol for kilometer, a distance of 1000 meters or 0.62 mile
L	Metric symbol for liter (approximately 1.06 quart)
lb	Symbol for pound
m	Metric symbol for meter
macroinvertebrate	A nonmicroscopic spineless animal, such as a mussel
meter	Metric unit of length equal to 39.37 inches
mg	Metric symbol for milligram, one thousandth of a gram (0.00003215 ounce)
MGD	Symbol for million gallons per day
mg/L	Metric symbol for milligrams per liter
microgram	Metric unit of mass equal to 1 millionth of a gram

micrometer	Metric unit of distance equal to 1 millionth of a meter
mL	Metric symbol for milliliter
MW	Metric symbol for megawatt
NEPA	Acronym for the National Environmental Policy Act
NH_3	Chemical symbol for ammonia
NH_3-N	Chemical symbol for ammonia nitrogen
NH_3-N/L	Amount of nitrogen from ammonia expressed on a per liter basis
NH_4HSO_4	Chemical symbol for ammonium bisulfate
NO_2	Chemical symbol for nitrogen dioxide
NOx	Generic symbol for nitrogen oxides
NPDES	Acronym for the National Pollutant Discharge Elimination System
opacity	Degree of haziness or visibility of stack emissions; non-transparency
ozone	A form of oxygen with three atoms in its molecule, formed in the atmosphere by photochemical reactions or by lightning. Ozone is a major pollutant in the lower atmosphere but a beneficial component of the upper atmosphere, where it blocks ultraviolet rays.
pH	A figure expressing acidity or alkalinity (7 is neutral, lower values are more acid and higher values more alkaline)
PM	Acronym for particulate matter
$PM_{2.5}$	Acronym for particulate matter with a diameter less than or equal to 2.5 micrometers
PM_{10}	Acronym for particulate matter with a diameter less than or equal to 2.5 micrometers
ppb	Acronym for parts per billion
ppmv	Acronym for parts per million by volume
residual soil	A soil that developed in place as a result of decomposition and disintegration of bedrock
salmonid	A general term for fish in the family Salmonidae, consisting of trout, salmon, whitefish, and char
SCR	Acronym for selective catalytic reduction
shale	a sedimentary rock formed by the deposition of successive layers of clay
SNCR	Acronym for selective noncatalytic reduction
SOx	Generic symbol for sulfur oxides
s.u.	Acronym for standard unit
TDEC	Acronym for Tennessee Department of Environment and Conservation
TRM	Acronym for Tennessee River Mile
TVA	Acronym for the Tennessee Valley Authority
urea	A crystalline organic compound of carbon, oxygen, nitrogen, and hydrogen, synthesized from carbon dioxide and ammonia, used in the manufacture of resins and fertilizers and for animal rations
U.S.	Acronym for the United States
USEPA	Acronym for the United States Environmental Protection Agency
USFWS	Acronym for the United States Fish and Wildlife Service
VOC	Acronym for volatile organic compound

APPENDIX A – RARE PLANTS NEAR JOHNSONVILLE FOSSIL PLANT

Rare Plant Species Reported From Within 5 Miles of the Proposed Project

Common Name	Scientific Name	State Status[1]/Rank[2]
American ginseng	*Panax quinquefolius*	S-CE (S3S4)
Hairy umbrella-sedge[3]	*Fuirena squarrosa*	S (S1)
Heller's cudweed	*Gnaphalium helleri*	S (S2)
Kidneyshape sedge	*Carex reniformis*	S (S1)
Lamance iris	*Iris brevicaulis*	E (S1)
Michigan lily	*Lilium michiganense*	T (S2)
Pubescent sedge	*Carex hirtifolia*	S (S1)
Short's rock-cress	*Arabis shortii*	S (S2)
Smaller mud-plaintain	*Heteranthera limosa*	T (S1)
Sweet-scented Indian-plantain	*Synosma suaveolens*	T (S2)
Virginia rose	*Rosa virginiana*	S (SH)

[1]S =Species of special concern; T=Threatened; E=Endangered; S-CE= Special concern, commercially exploited.

[2]S1=Extremely rare and critically imperiled in the state with 5 or fewer occurrences; S2=Very rare and imperiled within the state, 6 to 20 occurrences; S3=Rare and uncommon in the state, from 21 to 100 occurrences; S4=Widespread, abundant, and apparently secure within the state; SH=Of historical occurrence in Tennessee, i.e., known to occur in Tennessee in the past, with the expectation that it may be rediscovered.

[3]Record found in adjacent Benton County.

APPENDIX B – RARE ANIMALS NEAR JOHNSONVILLE FOSSIL PLANT

Federally and State-Listed Terrestrial Animal Species Reported From Benton and Humphreys Counties, Tennessee

Common Name	Scientific Name	Federal Status	State Status
Eastern hellbender	*Cryptobranchus alleghaniensis*	--	In Need of Management
Anhinga	*Anhinga anhinga*	--	In Need of Management
Great egret	*Casmerodius alba*	--	In Need of Management
Little blue heron	*Egretta caerulea*	--	In Need of Management
Bald eagle	*Haliaeetus leucocephalus*	Threatened	Threatened
Bewick’s wren	*Thryomanes bewickii bewickii*	--	Endangered
Gray bat	*Myotis grisescens*	Endangered	Endangered
Allegheny woodrat	*Neotoma magister*	--	In Need in Management
Southeastern shrew	*Sorex longirostris*	--	In Need of Management
Meadow jumping mouse	*Zapus hudsonius*	--	In Need of management
Alligator snapping turtle	*Macrochelys temminckii*	--	In Need of Management
Northern pine snake	*Pituophis melanoleucus melanoleucus*	--	Threatened
Western pigmy rattlesnake	*Sistrurus miliarius streckeri*	--	Threatened

APPENDIX C – CORRESPONDENCE

United States Department of the Interior

FISH AND WILDLIFE SERVICE
446 Neal Street
Cookeville, TN 38501

RECEIVED
Environmental Policy and Planning

MAY 22 2006

Doc. Type: EA Administrative Record
Index Field: Consultation / Interagency Rev
Project Name: SNCR Project JOF Units 1-4
Project No.: 2006-48

May 17, 2006

Mr. Jon M. Loney
Manager, NEPA Administration
Tennessee Valley Authority
400 West Summit Hill Drive
Knoxville, Tennessee 37902-1499

Re: FWS No. 2006-FA-0768

Dear Mr. Loney:

Thank you for your letter and enclosure received on April 28, 2005, regarding the Draft Environmental Assessment (EA) entitled Selective Noncatalytic Reduction Project Johnsonville Fossil Plant - Units 1 – 4, Humphreys County, Tennessee. The proposed action includes the removal of nitrogen oxides by urea-based selective noncatalytic reduction processes. We previously reviewed ammonia slip and discharge modeling and discussed these preliminary findings with TVA Natural Heritage program personnel. U.S. Fish and Wildlife Service (Service) personnel have reviewed the additional information submitted and offer the following comments for consideration. This letter supersedes and replaces our letter on this subject dated May 11, 2006.

The draft EA is adequate and support the conclusions of "no effect" for the federally endangered gray bat (*Myotis grisescens*) and "not likely to adversely affect" for the federally endangered pink mucket (*Lampsilis abrupta*), with which we concur. In view of this, we believe that the requirements of section 7 of the Endangered Species Act of 1973, as amended, are fulfilled. Obligations under section 7 of the Act must be reconsidered if (1) new information reveals impacts of the proposed action that may affect listed species or critical habitat in a manner not previously considered, (2) the proposed action is subsequently modified to include activities which were not considered during this consultation, or (3) new species are listed or critical habitat designated that might be affected by the proposed action.

Thank you for the opportunity to comment on this action. If you have any questions, please contact Steve Alexander of my staff at 931/528-6481 (ext. 210) or via e-mail at *steven_alexander@fws.gov*.

Sincerely,

Lee A. Barclay

Lee A. Barclay, Ph.D.
Field Supervisor

xc: Stephanie Chance, TVA, Knoxville

TENNESSEE HISTORICAL COMMISSION
DEPARTMENT OF ENVIRONMENT AND CONSERVATION
2941 LEBANON ROAD
NASHVILLE, TN 37243-0442
(615) 532-1550

February 1, 2006

Mr. J. Bennett Graham
Tennessee Valley Authority
400 W. Summit Hill Drive
WT 11D - Cultural Resources
Knoxville, Tennessee 37902

RE: TVA, CULTURAL RESOURCES ASSESSMENT, JOHNSONVILLE FOSSIL PLANT UNIT 4, JOHNSONVILLE, HUMPHREYS COUNTY, TN

Dear Mr. Graham:

At your request, our office has reviewed the above-referenced archaeological and architectural survey report in accordance with regulations codified at 36 CFR 800 (Federal Register, December 12, 2000, 77698-77739). Based on the information provided, we find that the project area contains no historic properties eligible for listing in the National Register of Historic Places.

If project plans are changed or archaeological remains are discovered during construction, please contact this office to determine what further action, if any, will be necessary to comply with Section 106 of the National Historic Preservation Act.

Your cooperation is appreciated.

Sincerely,

Herbert L. Harper

Herbert L. Harper
Executive Director and
Deputy State Historic
Preservation Officer

HLH/jmb

APPENDIX D – DETAILED SAMPLING PLAN FOR THE JOHNSONVILLE FOSSIL PLANT SNCR OPERATION – UNITS 1-4

DETAILED SAMPLING PLAN FOR THE
JOHNSONVILLE FOSSIL PLANT SNCR OPERATION - UNITS 1-4
April 2006

OBJECTIVE

The sampling plan has three objectives: (1) to establish a correlation between SNCR operating parameters (number of SNCR units operating, urea usage, coal type, unit load, slip rate) and ammonia concentrations in the ash pond; (2) to quantify ammonia uptake in the ash pond; and (3) to assess potential impacts to the receiving stream. This plan provides an operating procedure with explicit instructions for conducting the sampling. Review of the analytical data would also help determine the appropriate mitigation measures to implement, if deemed necessary, to ensure there would be no significant impact to the water environment during SNCR operation.

BACKGROUND

The 2005 Unit 1 SNCR demonstration sampling was conducted during the ozone season (July 12 to October 4). During the demonstration, the ammonia slip rate averaged 2 ppmv, and remained below 5 ppmv while achieving optimum performance of the system. Nine of the 12 samples collected at the ash pond discharge weir during SNCR operation had ammonia concentrations that were less than the minimum detection limit. The highest ammonia concentration at the discharge was 0.06 mg NH_3-N/L at pH 8.32, which is two orders of magnitude lower than the CMC for ammonia at pH 9.0 (1.32 mg NH_3-N/L). Comparing the average ash pond inflow ammonia concentration with the average ammonia concentration measured near the discharge weir, ammonia removal in the ash pond was 71 percent.

Water samples would be collected from the same locations and at the same frequency as the 2005 demonstration sampling. Sampling would be conducted during SNCR operation, which could be year-round, and would include background sample collection.

For the units with operating SNCRs, buildup of ammoniated ash on the APHs could be a concern during the unit outage APH cleanings. APH cleaning wastewater would be contained and analyzed for ammonia and pH prior to being discharged to the ash pond. Evaluation of the data would determine if staged releases of the APH cleaning wastewater would be required to prevent a significant impact to the ash pond and/or the Tennessee River. If a staged release of the wastewater were required, ash pond water samples would be collected during the staged release. At any time, the frequency of sample collection, location/number of sample sites, and the overall sampling scheme presented in this plan could be altered to provide the best data for decision-making and to reduce/eliminate unnecessary sampling and analyses.

RESPONSIBLE PERSONNEL

<u>JOF Site Support</u>

PA(E) - Tony Dillon- 931-535-8206
Sampler/Sample Shipments to Labs – to be determined
SNCR Operation Conditions Report - Unit Operators

<u>TVA Central Laboratories Services Support</u>

Water Sample Analysis - Jim Dillard - 423-876-6762
Sample Containers - Skip O'Rear - 423-876-6757

<u>Environmental Testing Solutions</u>

Toxicity Analysis - Kelly Keenan - 828-350-9364

Analytical Data Review, Interpretation and Reporting

Environmental Affairs NPDES Specialist - Mike Stiefel - LP 5D-C, 423-751-6844
Fossil Engineering and Technical Services - William A. Thomas, Jr. - LP 5H-C, 423-751-3845
Environmental Engineering Services Support - Anne Aiken - MR 2U-C, 423-751-3006

PROJECT DESCRIPTION

Water Sampling

Water sample collection must follow USEPA-approved methods and procedures to ensure that samples taken are representative of the medium being sampled; to ensure proper sampling, handling, and preservation techniques; to ensure proper identification of samples and proper documentation of their collection; to maintain chain-of-custody; and to protect collected samples by properly packing and transporting them to the designated laboratories for analysis and testing.

A daily record of the urea usage for each unit (total urea used during a 24-hour period in gallons), unit load (average megawatt [MW] generation during a 24-hour period), and type of coal being burned in each unit would be kept for the duration of the SNCR operations. If the slip rate is known, that information would be noted as well. The date/time of each sample collection/measurement would be recorded, as well as weather conditions and other field notes as appropriate.

Plant Intake and Ash Pond Routine Sampling

Water samples would be collected routinely from the plant intake (Intake) and from three locations at the ash pond—the inflow (A-1), an intermediate point (A-2), and near the discharge weir (A-3). One set of background samples would be collected prior to startup of any SNCR system. No background toxicity samples would be collected. These water samples would be collected on a weekly basis during the SNCR operations, and would continue for at least one week after the SNCR operations cease. See Table 1 for sample location descriptions.

Table 1. Water Sample Location and Frequency

Location Identification	Frequency	Location Description
Intake	Weekly	Samples would be collected from the plant intake.
A-1	Weekly	Samples would be collected from downstream of the sluice pipe discharges after complete mixing.
A-2	Weekly	Samples would be collected from an intermediate point upstream of the CO_2 sparger.
A-3	Weekly	Samples would be collected from the midway point of the discharge weir walkway (in-pond samples).

The samples collected from the plant intake (Intake) and from the ash pond (A-1, A-2, and A-3) would be grab samples. These samples would be analyzed for the following parameters: pH, temperature, ammonia-N, nitrate-nitrate-N, and total kjeldahl nitrogen. The sample containers for the nitrogen species would be predosed with acid for sample preservation. The samples would be carefully added to the predosed bottles leaving a headspace of 2-5 milliliters (mL) to avoid overflowing and to allow for mixing. Once the container is properly closed, the sample would be shaken to mix the acid and sample thoroughly, then placed on ice (see Table 2).

Table 2. Information Required for Sampling and Analysis

Sampling Event	Media	Parameter	Analytical Method*	Container Type	Volume of Sample	Preservation (not including predosing of containers)	Maximum Hold Time	Lab
Routine Water Sampling Intake, A-1, A-2, A-3 and During Staged Releases of APH Wash Wastewater A-1, A-2, A-3	water	Ammonia as N	EPA 350.1	Poly, Glass - predosed	250 mL	Cool to 4°C	28 days	TVA CLS
			In-Situ Probe	--	--	--	--	--
		Nitrate-Nitrite as N	EPA 353.2	Poly, Glass - predosed	250 mL	Cool to 4°C	28 days	TVA CLS
		Total Kjeldahl Nitrogen	EPA 351.2	Poly, Glass - predosed	250 mL	Cool to 4°C	28 days	TVA CLS
		pH	In-Situ Probe	--	--	--	--	--
		Temperature	In-Situ Probe	--	--	--	--	--
APH Wash Wastewater in Containment	water	Ammonia as N	In-Situ Probe	--	--	--	--	--
		pH	In-Situ Probe	--	--	--	--	--
Contingency Toxicity Sampling at A-3**	water	Toxicity	48-hour Definitive Static Tests	Plastic Cubitainer	5 gallons	Cool to <6°C	Immediate Overnight Transport	ETS
		Conductivity***	In-Situ Probe or Lab Analysis (sample not to be held >24 hours)	--	--	--	--	--
		Dissolved Metals***	EPA 200.7	Polyethylene predosed	500 mL	Filter, Cool to 4°C	6 months	TVA CLS
		Ammonia as N***	EPA 350.1	Poly, Glass - predosed	250 mL	Cool to 4°C	28 days	TVA CLS
		Alkalinity***	EPA 310.1	Poly, Glass	1 Liter	Cool to 4°C	14 days	TVA CLS
		Hardness***	SM 2340B	Poly, Glass - predosed	1 Liter	None required	6 months	TVA CLS
		Chlorides***	EPA 325.2	Poly, Glass	1 Liter	None required	28 days	TVA CLS
		Total Sulfate***	EPA 375.4	Poly, Glass	1 Liter	Cool to 4°C	28 days	TVA CLS

CLS = Central Laboratories Services
ETS = Environmental Testing Solutions
EPA = USEPA or United States Environmental Protection Agency
* Use listed method or other EPA/Standard Method-approved methodology.
** Based on ammonia-N concentration trigger of >= 4.0 mg/L at pH <8.0, or >= 0.5 CMC at pH >= 8.0.
***Analyzed in the event of a toxicity test failure.

Unit Outage Air Preheater Wash Water Sampling

For units with SNCR systems, the APH wash wastewater would be contained in the chemical treatment pond, portable storage (“frac”) tanks, or other containment(s). Prior to being discharged to the ash pond, the ammonia concentration and pH would be determined inside the containment(s) using in-situ probes (see Table 2). The ammonia and pH levels would determine the appropriate release rate to the ash pond. If a staged release of the APH wash wastewater were required, samples would be collected daily from the inflow, intermediate point, and near the discharge weir of the ash pond (A-1, A-2, and A-3) for the duration of the staged release and continue for two additional days (to account for the ash pond retention time) after the APH wash water discharge ceases. The samples collected at A-1, A-2, and A-3 would be analyzed for the same parameters as the routine water samples, and therefore the samples would be handled in the same manner.

A daily record of the urea usage for each unit (total urea used during a 24-hour period in gallons), unit load (average MW generation during a 24-hour period), and type of coal being burned in each unit would be kept for the duration of the SNCR operations. If the slip rate is known, that information should be noted as well. The date/time of each sample collection/measurement would be recorded, as well as weather conditions and other field notes as appropriate.

Contingency Sampling

The ammonia concentration and pH would be measured weekly during routine sampling (and during a staged release of the APH wash wastewater) near the ash pond discharge weir (A-3) using in-situ probes. If the ammonia nitrogen concentration reaches or exceeds 4.0 mg/L at a pH of less than 8.0, or the ammonia concentration reaches or exceeds 0.5 x the ammonia CMC at pH 8.0 or higher, then samples would be collected for toxicity analysis at sample location A-3.

If the determination were made to collect toxicity samples, then the conductance of the water at A-3 would be determined using an in-situ probe. Grab samples would be collected for toxicity tests, and split samples would be collected for possible dissolved metals, ammonia, alkalinity, hardness, chlorides, and total sulfate analyses (see Table 2). The split samples collected for dissolved metals, ammonia, alkalinity, hardness, chlorides, and total sulfate analyses would only be analyzed in the event of a toxicity test failure. The split samples would be sent to the TVA Central Laboratories Services lab in Chattanooga, Tennessee.

Toxicity samples would be collected using a cleaned plastic bucket and poured into new 2.5- or 5.0-gallon sample containers (e.g., Cubitainers®) that would have been rinsed in sample water immediately before sample collection. Each container would be completely filled with sample (no air space) and capped. The toxicity samples would be placed on ice for transport to the toxicity-testing laboratory in Asheville, North Carolina, via overnight commercial courier service. Samples would be stored at less than (<) 6 degrees Celsius (°C) until used in tests. Toxicity would be determined during an acute (48-hour) time frame using the daphnid, *Ceriodaphnia dubia*, and the fathead minnow, *Pimephales promelas*. Testing would follow USEPA methods defined in *Methods for Measuring the Acute Toxicity of Effluents and Receiving Water to Freshwater and Marine Organisms, Fifth Edition* (EPA-821-R-02-012).

The dissolved metals samples must be filtered through a 0.45-micrometer average pore diameter cellulose ester membrane filter (or other chemically inert filter) at the time of sample collection using a plastic filtering apparatus. (Plastic would be required to avoid interference with the boron analysis.) The dissolved metals samples would be analyzed for the following metals: aluminum, arsenic, barium, boron, cadmium, chromium, copper, calcium, iron, lead, magnesium, manganese, mercury, nickel, selenium, silver, and zinc using EPA method 200.7.

The sample containers for the dissolved metals, ammonia, and hardness samples would be predosed with acid for sample preservation. The dissolved metals samples must be filtered before being added to the preservative in the sample container. All of the samples would be carefully added to the predosed bottles leaving a headspace of 2-5 mL to avoid overflowing and to allow for mixing. Once the containers are properly closed, they would be shaken to mix the acid and sample thoroughly, then placed on ice.

Results of the contingency sample analyses would be used to determine the need for mitigation to meet NPDES permit limits for whole effluent toxicity in the ash pond effluent.

A daily record of the urea usage for each unit (total urea used during a 24-hour period in gallons), unit load (average MW generation during a 24-hour period), and type of coal being burned in each unit should be kept for the duration of the SNCR operations. If the slip rate is known, that information should be noted as well. The date/time of each sample collection/measurement would be recorded, as well as weather conditions and other field notes as appropriate.

Notifications

If at any time the ammonia (as N) concentration in the ash pond (sample location A-1, A-2, or A-3), as measured by the in-situ probe, were 3 mg/L or greater, the sampler would notify the PA(E). The PA(E) would notify the Environmental Affairs NPDES Specialist, and an appropriate course of action would be developed through discussions with appropriate representatives of the plant and project team.

Copies of all field notes, records, and data, and the lab reports should be sent to Mike Stiefel, William A. Thomas, Jr., and Anne Aiken.

Shipping/Mailing Addresses

Samples for fathead minnow and daphnid toxicity testing would be shipped to:
Environmental Testing Solutions c/o Kelly Keenan
351 Depot Street
Asheville, NC 28801

All other water samples would be shipped to:
TVA Central Laboratories Services
4601 North Access Road, Building A
Chattanooga, TN 37415

<u>Copies of field notes/records/data, and laboratory results would be sent to the following three people:</u>

Mike Stiefel	William A. Thomas, Jr.	Anne Aiken
1101 Market Street, LP 5D	1101 Market Street, LP 5H	1101 Market Street, MR 2U
Chattanooga, TN 37402	Chattanooga, TN 37402	Chattanooga, TN 37402